



Foundation Works

BUILDING FOUNDATION

Foundation is the lowest, artificially prepared parts of a structure which is in direct contact with the ground and which transmits the loads of the structure to the ground. The purpose of foundation is to transmit the anticipated loads safely to the soil.

Advantages of foundation

1. To distribute the total load coming from the structure over larger area of soil
2. To support the structure
3. To give stability to the structure
4. To prepare a level surface for concreting and masonry work

Footing

The lowermost portion of the foundation which is in direct contact with the sub-soil is called the footing.

Types of Foundation

Depending upon their nature and depth, the foundations are —

- a) Shallow foundation
- b) Deep foundation

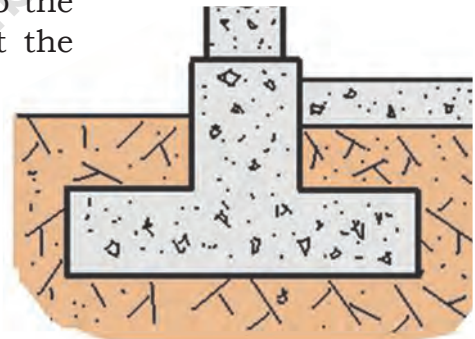


Fig.7.1: Shallow Foundation

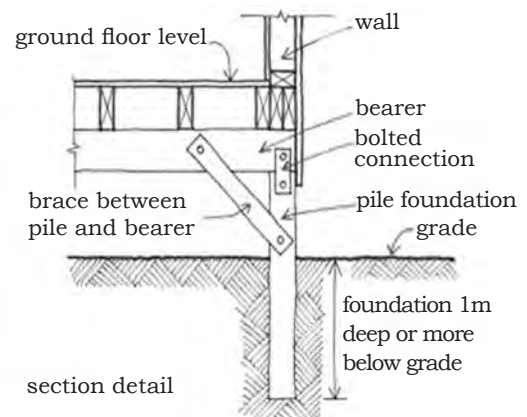


Fig.7.2: Deep Foundation

Shallow Foundation

This is the most common type of foundation and can be laid using open excavation by allowing natural slopes on all sides. This type of foundation is practicable for a depth of about 1-1.5 m and is normally convenient above the water table. The base of the structure is enlarged or spread to provide individual support (Width is greater than its depth).

Types of shallow foundations

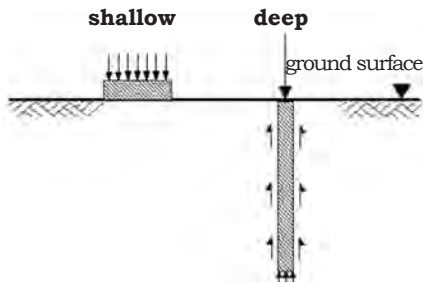


Fig.7.3: Shallow and Deep Foundations

- a) Wall footing
- b) Isolated footing
- c) Combined footing
- d) Inverted footing
- e) Continuous footing
- f) Cantilever footing
- g) Grillage footing
- h) Mat or raft foundation

Deep Foundation

These foundations carry loads from a structure through weak compressible soil or fills onto the stronger and less compressible soils or rocks at depth. These foundations are in general used as basements, buoyancy rafts, cylinders, shaft and piles. (Depth is greater than its width)

Types of deep foundations are classified as

- a) Basements
- b) Buoyancy rafts
- c) Well and caissons
- d) Shaft foundations
- e) Pile foundations

The causes for the failure of foundations

- a) Non-uniform settlement
- b) Horizontal movement of the soil
- c) Alternate swelling and shrinkage
- d) Lateral pressure due to lateral movement of earth
- e) Action of weathering agencies
- f) Lateral escape of the soil beneath the foundation of structure
- g) Roots of trees and shrubs

SESSION 1: EXCAVATION

NOTES

Excavation is the preliminary activity of the construction project. It starts from the pits for the building foundations and continues up to the handing over of the project.

Tools required

The following are the materials used for the earthwork for foundation.

1. Spade
2. Kassi
3. Pick Axe
4. Crow Bar
5. Rammer
6. Wedge
7. Boning Rod
8. Sledge Hammer
9. Basket
10. Iron Pan
11. Line and Pins

Drawings required

1. Center line Drawing
2. Layout Plan

Size of foundation

- a) For Main Walls 4'0" Depth
- b) For Partition Walls 2'0" Depth

Points to be observed during excavation work

- Setting out of corner benchmarks
- Survey for ground levels
- Survey for top levels
- Excavation to approved depth
- Dressing of loose soil
- Making up to cut off level
- Constructing dewatering wells and interconnecting trenches
- Marking boundaries of the building
- Constructing protection bunds and drains

NOTES

Points to be observed during excavation

Excavation of soil is carried out manually or by excavation machinery, such as the JCB excavator machine, etc. Before excavation, it is necessary to know the soil strata; it is advised that trial pits in the construction site are made to check actual soil and rock strata.

The excavation and depth is decided according to the following guidelines on the site:

1. For Isolated footing — the depth to be one and half times the width of the foundation
2. For adjacent footings with clear spacing — less than twice the width (i.e.) one and half times the length
3. 1.5m in general and 3.5 m in black cotton soils
4. In construction site, open foundation pits for columns and trenches for coursed rubble (CR) Masonry was carried out. The maximum depth was upto 3m.

Procedure for making foundation

You have marked the line in the previous activity of mark centre line, similarly we have to do setting out or ground tracing. Ground tracing (Marking of line) is the process of laying down the excavation lines and center lines etc. on the ground before the excavation is started. The center line of the longest outer wall of the building is marked on the ground by stretching a string between wooden or mild steel pegs. Each peg may be projected about 25 to 50 mm from the ground level and 2m from the edge of the excavation. The boundary is marked with the lime powder. The center lines of other walls are marked perpendicular to the longer walls. A right angle can be formed by forming 3, 4 and 5 triangles. Similarly, outer lines of the foundation trench of each cross walls and are set out

Removal of Excess Soil

Estimate the excavated stuff to be re-utilised in filling, gardening, preparing roads, etc. As far as possible try to carry excavation and filling simultaneously to avoid double handling. Select and stack the required material in such a place that it should not obstruct other construction activities. The excess or unwanted material



should immediately be carried away and disposed of by employing any of the following methods.

- Labour
- Tractor trolley
- Trucks

Quality checks for excavation

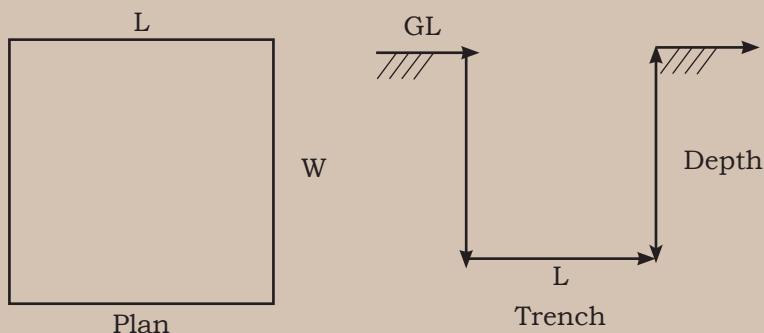
- Recording initial ground level and check size of bottom.
- Disposal of unsuitable material for filling.
- Stacking suitable material for backfilling to avoid double handling.
- Strata classification approval by competent authority.
- Dressing bottom and sides of pits as per drawing with respect to centerline.
- Necessary safety measures observed.

Quality checks for filling

- Recording initial ground level.
- Sample is approved for back filling.
- Necessary marking/reference points are established for final level of backfilling.
- Back filling is being carried out in layers (15cm to 20cm).
- Required watering, compaction is done.
- Required density is achieved.

Practical Activity

1. Carry out excavation activity for open trench as per foundation plan given below.



NOTES

SESSION 2: CONSTRUCT SPREAD FOOTING FOUNDATION

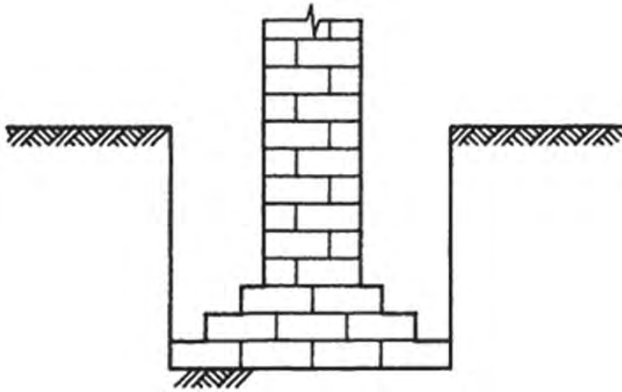


Fig.7.4: Spread Footing Foundation

In previous activities you have made the trench for a foundation, now we will construct a foundation in the trench. We will make a spread footing foundation to distribute the load of the wall over a larger area. Spread footing is applicable for load bearing structure. Mortar is used to fill the joints in brick masonry as it is the binding material. Generally a mixture of cement and sand are prepared in the ratio of 1:6.

Tools required

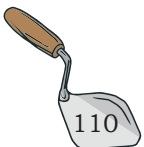
1. Mason square
2. Brick axe
3. Tape
4. Spade
5. Line dori
6. Plumb bob
7. Mortar pan (Tagadi)
8. Trowel

Material required

1. Bricks
2. Cement, sand and water

Procedure

1. Prepare a level of trench bed with plain cement concrete 1:5:10 and let it set for minimum 4 hours.
2. Bricks shall be soaked in the water properly before use properly
3. Cement and sand are placed on dry platform with 1:6 proportion
4. Add water as per required quantity in it and mix with the help of spade by turning side by side.
5. Now courses of the bricks are arranged as per given Fig. 7.4, in which first layer is three brick thick.
6. Mortar joints should be kept 10 mm thick.



7. Over the third layer, second layer of two brick thick with cement mortar joints.(10mm) shall be arranged properly.
8. Brick shall be laid on their beds and with the frog upside.
9. Minimum offset shall be $1/4$ th of length of brick.
10. In each course, vertical joints should be broken.
11. After 4 to 6 course of 2 brick thick, next layer consist of one first course
12. Horizontal level shall be checked with line *dori*.
13. After construction of foundation is completed, curing is done for three days.
14. Curing is the processes of applying water on newly constructed brickwork, stone work, cement concrete, plastering etc.
15. It is important to cure fresh work as cement, when in chemical process with water heat is produced to gain the compressive strength for the further period so cement is kept wet at least one week after construction activity.

Practical Activity

1. Visit a construction site and observe the method of construction of different types of foundation.

Check Your Progress

A. Fill in the blanks

1. Foundation is the lowest _____ prepared part below the surface of the surrounding ground.
2. Excavation is the _____ activity of the construction project.
3. The bearing capacity of soil is used to _____ maximum load per unit area which the soil will resist safely without _____.
4. Deep foundations _____ loads from a structure through weak compressible soil or fills onto the _____ and less compressible soils or rocks at depth.

B. Write short notes on

1. Foundations
2. Brick footing tools
3. Shallow foundation and Deep foundation
4. Excavation of soil trench